UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/769,490	01/26/2001	Kenji Itoga	49657-961	5521

7590 05/23/2002

McDERMOTT, WILL & EMERY
600 13th Street, N.W.
Washington, DC 20005-3096

EXAMINER
KAO, CHIH CHENG G

ART UNIT	PAPER NUMBER
2882	

DATE MAILED: 05/23/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/769,490	Applicant(s) ITOGA ET AL.
	Examiner Chih-Cheng Glen Kao	Art Unit 2882

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18,20-43 and 46-49* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18,20-43 and 46-49* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 January 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 9 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1, 2, 4, 14, 15, 24, 25, 27, and 37-39 are rejected under 35 U.S.C. 103(a) as obvious over Itabashi (JP 11-014800) in view of Bearden et al. (Reviews of Modern Physics). Itabashi discloses an x-ray exposure apparatus and method (Paragraph [0001]) comprising: an x-ray incidence step using a synchrotron radiation source (Paragraph [0016]) having a component in wavelength ranging from 0.45 nm through 0.7 nm (Paragraph [0012]) onto an x-ray mirror with a material such as ruthenium (Paragraph [0011]), and outgoing x-rays, which has a substantially identical outgoing direction and optical axis as the incidence step (Fig. 1), for an exposure step to manufacture a semiconductor device (Paragraph [0001]).

However, Itabashi does not specifically disclose the material having an absorption edge only in a wavelength region other than 0.4 nm through 0.7 nm nor the x-ray mirror emanating an x-ray having a peaked wavelength in a range from 0.45 nm to 0.7 nm.

Bearden et al. teaches ruthenium with an absorption edge only in a wavelength region other than 0.4 nm through 0.7 nm (Row in table containing element Ru). Note that when

converting each of the edges from energy to wavelength using the equation for energy of photons ($E = hc/\lambda$), wavelengths occur in a region other than 0.4 nm through 0.7 nm.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the absorption edges of Bearden et al. and the peaked wavelength with the device and method of Itabashi, since these properties were well known in the art at the time the invention was made as shown by Bearden et al and since obtaining the peaked wavelength or optimum value of a result effective variable involves only routine skill in the art. One would have been motivated to find a peaked wavelength to fine tune the laser for precise exposure methods.

2. Claims 3 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Itabashi in view of Bearden et al as applied to claims 1, 16, and 24 above. Itabashi in view of Bearden et al. suggest a device and method as recited above. However, Itabashi does not specifically disclose absorbing at least 90% of x-rays of a wavelength region of less than 0.3 nm.

On the other hand, Itabashi further discloses intensities of x-rays reflected differing when there is a change in incidence angle (Paragraph [0013] and Figs. 2 and 3).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to hav0e the absorption of at least 90% of x-rays with wavelengths less than 0.3 nm with the suggested device and method of Itabashi in view of Bearden et al., since it would have only involved routine skill in the art to discover an optimum or workable range based on one's engineering expediency where the general conditions of a claim are disclosed in the prior

art. All this would involve is tilting the mirror. One would be motivated to differ the absorption factor to raise exposure luminous efficacy as shown by Itabashi (Paragraphs [0005] and [0006]).

3. Claims 5-8, 13, 28-31, 36, 40-43, and 46-49 are rejected under 35 U.S.C. 103(a) as obvious over Itabashi in view of Bearden et al. as respectively applied to claims 1, 16, and 24 above, and further in view of Hasegawa et al. (US Patent 6219,400). For purposes of being concise, Itabashi in view of Bearden et al. suggests a device and method as recited above. However, Itabashi does not specifically disclose a plurality of mirrors that may converge and magnify with means to alter a peak wavelength while maintaining an optical axis or direction, wherein the outgoing light from the source and mirrors are substantially identical in direction and optical axis.

Hasegawa et al. teaches a plurality of mirrors that may converge (col. 2, lines 29-31) or magnify (Fig. 5) with means to tilt mirrors, which may alter a peak wavelength, while maintaining an optical axis or direction, wherein the outgoing light from the source and mirrors are substantially identical in direction and optical axis (Fig. 2 and col. 4, lines 10-14 and 19-26). Note that although Hasegawa et al. does not specifically teach that tilting a mirror will alter the peak wavelength, Itabashi has already disclosed that changing the tilt of a mirror alters a peak wavelength (Drawings 2 and 3 in Itabashi).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the plurality of mirrors that tilt, converge, and magnify of Hasegawa et al. with the device and method of Itabashi in view of Bearden et al., since one

would be motivated to have uniform exposure as shown by Hasegawa et al. (col. 4, lines 23-24) for more accuracy in lithography.

4. Claims 9, 10, 32, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Itabashi in view of Bearden et al. as applied to claims 1, 16, and 24 above, Itabashi in view of Bearden et al. suggests apparatuses and method as described above. However, Hasegawa et al. does not seem to specifically disclose an x-ray mirror surface upon which x-rays are incident being mechanically or chemically polished.

The Examiner takes Official Notice that mirrors are conventionally polished by mechanical or chemical means.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the mirrors polished mechanically or chemically with the suggested device and method of Itabashi in view of Bearden et al., since they are both considered conventional and well known functional equivalents at the time the invention was made. One of ordinary skill in the art would have found it obvious to use either means to polish a mirror and would be motivated to polish a mirror to prevent irregularities as shown by Itabashi (Paragraph [0003]) for more controlled exposure.

5. Claims 11, 12, 34, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Itabashi in view of Bearden et al. as applied to claims 1 and 24 above, and further in view of Reinecke et al. (EP 903638 A1). Itabashi in view of Bearden et al. suggests a device and method as recited above. However, Itabashi et al. does not specifically disclose an x-ray mask

comprising a membrane having an absorption edge only in either one of a wavelength region of less than 0.45 nm and a wavelength region exceeding 0.7 nm as to x-rays, and an absorber having an absorption edge in a wavelength region of at least 0.6 nm and less than 0.85 nm.

Reinecke et al. teaches an x-ray mask for an x-ray exposure apparatus comprising a membrane with a material such as beryllium, and an absorber with a material such as tungsten, (Paragraphs [0010] and [0012]). Bearden et al. further teaches beryllium with an absorption edge only in a wavelength region other than 0.4 nm through 0.7 nm (Row in table containing element Be) as well as tungsten with an absorption edge in a wavelength region of at least 0.6 nm and less than 0.85 nm. Note that when converting each of the edges from energy to wavelength using the equation for energy of photons ($E = hc/\lambda$), wavelengths occur in the above said regions.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the mask of Reinecke et al. with the absorption properties of Bearden et al., since these properties were well known in the art at the time the invention was made as shown by Bearden et al.

Secondly, it would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the mask of Reinecke et al. with the absorption properties of Bearden et al. and with the x-ray exposure apparatus and method of Itabashi in view of Bearden et al., since it would have only involved routine skill and routine experimentation to discover the optimum or workable ranges of a mask in combination with a mirror for an x-ray exposure apparatus. One would be motivated to combine the mask with the mirror because one would

want to insure that the intended wavelengths, which reflected from the mirror, pass through the mask to reach the sample, while unwanted wavelength regions are absorbed by the mask.

6. Claim 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yanagihara et al. (JP 06-194497). Yanagihara et al. discloses an x-ray mirror containing boron nitride (Title) for synchrotron radiation (Paragraph [0009]). However, Yanagihara et al. does not seem to specifically disclose the mirror providing light at least having a component in wavelength ranging from 0.45nm through 0.7nm.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the component wavelength ranging from 0.45 nm through 0.7nm with the structure of Yanagihara et al., since discovering workable ranges involves only routine skill in the art. It is general knowledge that as semiconductor manufacturing techniques require smaller parameters, wavelengths of light for exposure purposes must be smaller as well. Secondly, the recitation with respect to the manner, which a claimed apparatus is intended to be employed, does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. In this case, the claim is only drawn to the mirror. It does not matter how the mirror. The claim is only for the actual mirror itself.

7. Claim 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yanagihara et al. as applied to claim 16 above, and in further view of Itabashi. Yanagihara et al. suggests a device as recited above. However, Yanagihara et al. does not specifically disclose absorbing at least 90% of x-rays of a wavelength region of less than 0.3 nm.

Itabashi teaches intensities of x-rays reflected differing when there is a change in incidence angle (Paragraph [0013] and Figs. 2 and 3).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the absorption of at least 90% of x-rays with wavelengths less than 0.3 nm with the suggested device of Yanagihara et al., since it would have only involved routine skill in the art to discover an optimum or workable range based on one's engineering expediency where the general conditions of a claim are disclosed in the prior art. All this would involve is tilting the mirror. One would be motivated to differ the absorption factor to raise exposure luminous efficacy as shown by Itabashi (Paragraphs [0005] and [0006]).

8. Claims 20 and 21 are rejected under 35 U.S.C. 103(a) as obvious over Yanagihara et al. as applied to claim 16 above and further in view of Hasegawa et al. Yanagihara et al. suggests a device as recited above. However, Yanagihara et al. does not specifically disclose a plurality of mirrors that may converge and magnify.

Hasegawa et al. teaches a plurality of mirrors that may converge (col. 2, lines 29-31) or magnify (Fig. 5).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the plurality of mirrors that converge and magnify of Hasegawa et al. with the device of Yanagihara et al., since one would be motivated to have uniform exposure as shown by Hasegawa et al. (col. 4, lines 23-24) for more accuracy in lithography.

9. Claims 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yanagihara et al. as applied to claim 16 above. Yanagihara et al. suggests an apparatus as described above. However, Yanagihara et al. does not seem to specifically disclose an x-ray mirror surface upon which x-rays are incident being mechanically or chemically polished.

The Examiner takes Official Notice that mirrors are conventionally polished by mechanical or chemical means.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the mirrors polished mechanically or chemically with the suggested device of Yanagihara et al., since they are both considered conventional and well known functional equivalents at the time the invention was made. One of ordinary skill in the art would have found it obvious to use either means to polish a mirror and would be motivated to polish a mirror to prevent irregularities for more controlled exposure.

Response to Arguments

10. Applicant's arguments with respect to claims 1-18, 20-43, and 46-49 have been considered but are moot in view of the new ground(s) of rejection.

11. The rejection regarding the term "utilize" in claims 1 and 40 has been withdrawn.

12. The arguments with regards to absorption of at least 90% of x-ray with wavelengths less than 0.3 nm are not persuasive. This particular "characteristic" of the apparatus would have been obvious and inherent in a system with the same elements. Although, prior art does not seem to specifically state the said property as noted by the applicant, the characteristic of the system would still have been inherent or found obvious by one having ordinary skill in the art, since

discovering the optimum or workable ranges of the prior art would only involve routine skill in the art, such as tilting the mirror as implied in Itabashi.

13. The arguments with regards to claims 5-8, 13, 20, 21, 28-31, 36, 40-43, and 46-49 are not persuasive. Although Hasegawa does not seem to specifically disclose that if an x-ray mirror reflects light at a variable angle, the mirror still emanates light along an invariably maintained optic axis, Itabashi still teaches tilting the axis for altering peak wavelength. Hasegawa et al. teaches maintaining the optical axis. The combination of references would still have been obvious.

14. The arguments wit regards to claims 11-12 and 34-35 are not persuasive. LIGA (Lithographie, Galvanoformung, Abformung) uses lithography. One of ordinary skill in the art would know about any lithography device, which is the focus of the claims.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chih-Cheng Glen Kao whose telephone number is (703) 605-5298. The examiner can normally be reached on M - Th (8 am to 5 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Kim can be reached on (703) 305-3492. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

gk
May 18, 2002

ROBERT H. KIM
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800